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L9: Entry 26 of 46

File: USPT

Jun 28, 1994

DOCUMENT-IDENTIFIER: US 5324788 A

TITLE: Thermosetting coating compositions

Brief Summary Text (5):

EP-A 466,359 discloses a process for preparing phenol functionalized polymers by the polymerization of 4-acetoxystyrene and copolymerization of 4-acetoxystyrene and additional vinyl comonomers such as acrylates followed by transesterification with an alcohol. The polymers are taught to be useful as photoresist components for use in combination with UV, X-ray and E-beam imaging systems. Similarly, U.S. Pat. No. 4,857,601 discloses a process for preparing copolymers of 4-acetoxystyrene and dialkyl muconates or alkyl sorbates, followed by an alcohol or aqueous treatment with acid or base to provide the final phenol functionalized polymer.

Brief Summary Text (46):

Examples of preferred acrylate esters of Formula D include methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, n-butyl acrylate, n-propyl methacrylate, n-butyl methacrylate, isobutyl methacrylate, benzyl acrylate, 4 methyl benzyl methacrylate, furyl acrylate, methyl furyl acetate, 2-(2-thienyl) ethyl acrylate, n-hexyl acrylate, isoamyl methacrylate, 2-(hydroxyethyl) acrylate, 2-(hydroxyethyl) methacrylate, 3-(hydroxypropyl) methacrylate, 2-(ethoxyethyl) acrylate, 2-(methoxyethyl) methacrylate, glycidyl methacrylate, 2-ethylhexyl acrylate, cyclopentyl acrylate, cyclohexylmethyl methacrylate, cyclohexyl methacrylate, lauryl acrylate, lauryl methacrylate, stearyl methacrylate, stearyl acrylate, octyl acrylate, octyl methacrylate, tetrahydrofurfuryl acrylate, furfuryl methacrylate, 2-(acetoxylethyl) acrylate, 3-(acetoxylethyl) methacrylate, 2-(dimethylaminoethyl) acrylate, 3-(dimethylaminopropyl) methacrylate, acetoacetoxyethyl acrylate, acetoacetoxyethyl methacrylate, aceto-acetoxypropyl acrylate, and acetoacetoxypropyl methacrylate.

Detailed Description Text (4):

In a 500 mL round-bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (25 g), n-butyl acrylate (25 g), styrene (25 g), 4-acetoxystyrene (26.1 g), tert-dodecanethiol (0.2 g), and n-butanol (90 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (2.0 g), dissolved in n-butanol (10 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hr in three portions. The polymerization was complete after refluxing at 100.degree. C. for four hours by determining the percent solids of the reaction mixture. The resulting resin solution turned white upon cooling.

Detailed Description Text (8):

In a 500 mL round bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (25 g), n-butyl acrylate (25 g), styrene (25 g), 4-acetoxystyrene (13 g), 2-hydroxyethyl methacrylate (9 g), tert-dodecanethiol (0.2 g), and n-butanol (85 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (3.0 g), dissolved in n-butanol (15 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hour in three portions. The polymerization was complete after refluxing at 100.degree. C. for three hours by determining the percent solids of the reaction

mixture.

Detailed Description Text (11):

In a 500 mL round bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (53 g), n-butyl acrylate (17 g), 4-acetoxystyrene (26 g), tert-dodecanethiol (0.2 g), and n-butanol (85 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (3.0 g), dissolved in n-butanol (15 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hour in three portions. The polymerization was complete after refluxing at 100.degree. C. for four hours by determining the percent solids of the reaction mixture.

Detailed Description Text (14):

In a 500 mL round-bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (25 g), n-butyl acrylate (25 g), styrene (29.2 g), 2-hydroxyethyl methacrylate (18.6 g), tert-dodecanethiol (0.2 g), and methyl n-amyl ketone (MAK) (96 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (2.0 g), dissolved in MAK (10 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hour in three portions. The polymerization was complete after refluxing at 140.degree. C. for three hr by determining the percent solids of the reaction mixture. About 71 mL of the solvent was then distilled off at 155.degree. C. to give a resin with about 70% solids.

Detailed Description Text (16):

In a 500 mL round-bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (15 g), n-butyl acrylate (15 g), styrene (48 g), 2-hydroxyethyl methacrylate (19 g), tert-dodecanethiol (0.2 g), and methyl n-amyl ketone (MAK) (85 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (3.0 g), dissolved in MAK (15 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hour in three portions. The polymerization was complete after refluxing at 110.degree. C. for three hours by determining the percent solids of the reaction mixture. About 72 mL of the solvent was then distilled off at 160.degree. C. to give a resin with about 70% solids.

Detailed Description Text (27):

In a 500 mL round-bottom flask equipped with a water condenser were mixed with stirring the following compounds: methyl methacrylate (25 g), n-butyl acrylate (25 g), styrene (20 g), 4-acetoxystyrene (25 g), acrylic acid (2.57 g), tert-dodecanethiol (0.4 g), and n-butanol (85 g). The mixture was then heated to about 100.degree. C. and the stirring continued. A solution of initiator, azobisisobutyronitrile (AIBN) (4.0 g), dissolved in n-butanol (15 g) was prepared. This initiator suspension was added sequentially to the reaction mixture every 0.5 hour in three portions. The polymerization was complete after refluxing at 100.degree. C. for four hours by determining the percent solids of the reaction mixture.

Current US Cross Reference Classification (4):

526/326

CLAIMS:

3. The enamel composition of claim 1, wherein (a) is selected from the group consisting of 2-acetoxystyrene, 3-acetoxystyrene, and 4-acetoxystyrene.

6. The enamel composition of claim 1, wherein (c) is selected from the group consisting of methyl methacrylate, butyl acrylate, isobutyl methacrylate, lauryl methacrylate, 2-ethylhexyl acrylate, 2-hydroxyethyl methacrylate, acetoacetoxypropyl methacrylate, acetoacetoxyethyl methacrylate, and glycidyl methacrylate.

8. The enamel composition of claim i, wherein

(a) is 4-acetoxystyrene;

(b) is styrene;

(c) is methyl methacrylate or butyl acrylate or a mixture thereof; and

(d) is acrylic acid or methacrylic acid or a mixture thereof.

14. The water-borne enamel composition of claim 12, wherein (a) is selected from the group consisting of 2-acetoxystyrene, 3-acetoxystyrene, and 4-acetoxystyrene.

17. The water-borne enamel composition of claim 12, wherein (c) is selected from the group consisting of methyl methacrylate, butyl acrylate, isobutyl methacrylate, lauryl methacrylate, 2-ethylhexyl acrylate, 2-hydroxyethyl methacrylate, and glycidyl methacrylate.

20. The water-borne enamel composition of claim 12, wherein

(a) is 4-acetoxystyrene;

(b) is styrene;

(c) is methyl methacrylate or butyl acrylate or a mixture thereof; and

(d) is acrylic acid or methacrylic acid or a mixture thereof.

**WEST****Collections****Definition, Editing, Browsing**

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**Name:** Undefined**Contents:**

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**WEST**

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L28: Entry 10 of 12

File: USPT

Aug 22, 2000

DOCUMENT-IDENTIFIER: US 6107425 A

TITLE: Narrow molecular weight distribution polymers and use of same as resin binders for negative-acting photoresists

Brief Summary Text (23):

Such decreased absorbance is a substantial benefit for photolithographic applications. For example, a resist coating layer containing polymer(s) of the invention with low optical density can exhibit increased photospeed relative to a comparable resist that contains a more highly absorbing resin binder. Sufficiently high photospeed is important or even critical in many applications, e.g. where a number of exposures are needed such as in generating multiple patterns by a step and repeat process, or where activating energy of reduced intensity is employed. Sufficiently high photospeed also permits reduction in the concentration of the radiation sensitive component in the photoresist. Lower absorbing resist formulations also can provide higher resolution and higher profiles due to more even distribution of photons (acid) within a resist film. Low absorbing resists are particularly advantageous when used on low reflecting substrates such as antireflective coatings.

Detailed Description Text (40):Part A. Polymerization of 4-Acetoxystyrene.Detailed Description Text (41):

Acetoxystyrene (75.0 g, 0.463 mol) was placed in a 250 mL round bottom flask and purged with N.sub.2. The unimolecular initiating system 1-phenyl-1-(2',2',6',6'-tetramethyl-1'-piperidinyloxy)-ethane (1.21 g, 0.00463 mol) (with no separate free radical initiator used) was then added to the monomer. After addition of the initiator, the polymerization mixture was heated to 125-130.degree. C., under N.sub.2, and stirred for 48 hours. During the polymerization the polymer solidified in the reaction vessel. The reaction was then cooled to room temperature and the polymer dissolved in acetone (225 mL), and isolated by precipitation into hexanes (2250 mL). The polymer was then filtered, washed with hexanes and dried in a vacuum oven at 60.degree. C. overnight. Isolated yield was 90% of theory, M.sub.n = 8997, M.sub.w /M.sub.n = 1.10.

Detailed Description Text (42):Part B. Deacetylation of Poly(4-acetoxystyrene).Detailed Description Text (43):

To a gently refluxing slurry of poly(4-acetoxystyrene) (50.0 g, 0.308 mol) in methanol (200 mL), under N.sub.2, ammonium hydroxide (24.25 g, 0.692 mol) dissolved in water (36 mL) was added dropwise over 15 minutes. After addition, the reaction mixture was gently refluxed for 18 hours, during which time the polymer went into solution. The reaction is then cooled to room temperature, and the polymer isolated by precipitation into water (1500 mL), filtered, washed well with water, and dried in a vacuum oven at 50.degree. C. overnight. Isolated yield of poly(4-hydroxystyrene) was 80-90% of theory, M.sub.n = 6528, M.sub.w /M.sub.n = 1.22, Tg=177.degree. C.

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L28: Entry 11 of 12

File: USPT

Sep 28, 1999

DOCUMENT-IDENTIFIER: US 5958654 A

TITLE: Lithographic process and energy-sensitive material for use therein

Brief Summary Text (35):

The second polymer is a hydroxystyrene polymer in which a number of the hydroxyl (OH) moieties have been replaced by substituents that form hydrogen bonds with the hydroxyl substituents. Examples of suitable substituents include carboxyl substituents, RCOO--, wherein R is an alkyl moiety having at least one but no more than about eight carbon atoms, a cycloalkyl moiety having no more than about eight carbon atoms, or substituted benzyl and phenyl moieties wherein the substituent groups are either alkyl groups with eight or less carbon atoms or halo (e.g. fluoro and chloro) groups. Further examples of R include oxygenated alkyls wherein the total number of carbon atoms is eight or less. Examples of suitable oxygenated alkyls include --CH.sub.2 --O--(CH.sub.2).sub.n --CH.sub.3 and --CH.sub.2 --O--(CH.sub.2 --O).sub.n --CH.sub.3 wherein n is 0 to 6. In one embodiment of the present invention, the second polymer is copolymer of acetoxystyrene and hydroxystyrene.

Detailed Description Text (4):

A copolymer of hydroxystyrene and acetoxystyrene was prepared by dissolving, in a round bottom flask, polyhydroxystyrene (8.58 g; 71.5 mmol) in THF (30 g). Pyridine (1.7 g; 21.5 mmol) was added to the polyhydroxystyrene solution. Acetic anhydride (3.5 g; 34.28 mmol) and additional pyridine (2.12 mL; 26.8 mmol) were then added to the reaction flask. The flask was then placed in a 55.degree. C. bath for 120 minutes. The polymer was recovered from the reaction liquid by precipitation in distilled water in a blender (1 part solution per 8 parts water in 500 mL of water). The precipitated polymer was dried in a vacuum oven for 16 hours at 80.degree. C. The acetic anhydride was obtained from the Aldrich Chemical Co. The resulting copolymer (P(HS/ACS)) was 50 mole percent hydroxystyrene and 50 mole percent acetoxystyrene.

Detailed Description Text (5):

The protected copolymer of hydroxystyrene and ethylvinyl ether (HS/EVE) and the copolymer of hydroxystyrene and acetoxystyrene (HS/ACS) were combined to form resist materials. The two polymers were combined in the weight ratios of 3:1; 4:1; and 5:1. In the HS/EVE copolymer, a number of the hydroxyl moieties pendant to the aromatic ring were reacted with ethylvinyl ether and the hydrogen atoms of a portion of the hydroxyl groups are replaced by alkyl ether moieties. In the HS/ACS copolymer, a number of the hydroxyl moieties pendant to the aromatic ring were reacted with acetic anhydride and the hydrogen atoms of a portion of the hydroxyl groups are replaced by alkyl carbonyl moieties. For ease of description, the polymers are described in terms of the relative amounts of the hydroxyl, alkyl ether, and alkyl carbonyl moieties present on the polymers in the blend.

Detailed Description Text (10):

Two types of silicon wafers were used to analyze the lithographic performance of the polymer blend resist materials. Bare silicon wafers primed with hexamethyldisilazane (HMDS) in a Yield Engineering Systems, Inc. (Y.E.S.) oven and unprimed silicon wafer coated with an organic antireflective coating were used as substrates. Resist materials containing the polymer blends described in Table 1 were prepared and each resist material was applied on each type of wafer. The resist processing steps (i.e.

spin, bake, and develop) were all done using a Machine Technologies Incorporated (MTI) FLEXILAB wafer track.

CLAIMS:

5. The process of claim 4 wherein the second polymer is a copolymer of hydroxystyrene and acetoxystyrene.

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L28: Entry 3 of 12

File: USPT

Jun 25, 2002

DOCUMENT-IDENTIFIER: US 6410209 B1

TITLE: Methods utilizing antireflective coating compositions with exposure under 200 nmBrief Summary Text (3):

The present invention relates to compositions that reduce reflection of exposing radiation from a substrate back into an overcoated photoresist layer. More particularly, the invention relates to antireflective coating compositions ("ARCs") that contain a resin binder components that effectively absorbs short-wavelength exposure radiation, including sub-200 nm radiation such as 193 nm radiation.

Brief Summary Text (13):

It thus would be desirable to have new antireflective coating compositions. It would be particularly desirable to have new antireflective coating compositions that effectively absorb undesired reflections of short wavelength radiation, including sub-200 nm radiation such as 193 nm.

Brief Summary Text (15):

The present invention provides new light absorbing compositions suitable for use as an antireflective coating composition ("ARC"), particularly for short wavelength imaging applications, such as 193 nm imaging. The ARCs of the invention in general comprise a resin binder that effectively absorbs short wavelength exposure radiation to reduce reflections of same, and optionally comprise a crosslinker component.

Detailed Description Text (18):

A terpolymer of 4-acetoxystyrene: 2-hydroxymethacrylate: methylmethacrylate was synthesized according to the procedure of Example 1 in a mole % ratio of 18:38:44. Example 1; with the mole % of the initiator (Vazo 52) at 0.36%. Polymer yield was 84%. Molecular weight analysis by gel permeation chromatography relative to polystyrene standards gave a Mw=73888, Mn=29973. Subsequent analysis found T.sub.g =74.degree. C., T.sub.d =247.degree. C.

Other Reference Publication (1):

Xu et al., "New Antireflective Coatings for 193 nm Lithography", SPIE, vol. 3333, pp. 524-531, 1998.



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L28: Entry 4 of 12

File: USPT

Mar 19, 2002

DOCUMENT-IDENTIFIER: US 6358665 B1

TITLE: Radiation-sensitive composition of chemical amplification type

Brief Summary Text (108):

According to the composition of the present invention, the base skeleton of the hydroxystyrene based resin is not particularly limited and may be properly determined by taking into consideration applications of the composition, radiation wavelength for exposure, production conditions, chemical composition and the like. According to a preferred embodiment of the present invention, examples of hydroxystyrene based resins usable herein include: poly-(4-hydroxystyrene); poly-(3-hydroxystyrene); poly-(2-hydroxystyrene); and copolymers of 4-, 3-, or 2-hydroxystyrene with other monomers, particularly bipolymers and terpolymers. Examples of other monomers usable herein include 4-, 3-, or 2-acetoxystyrene, 4-, 3-, or 2-alkoxystyrene, styrene, .alpha.-methylstyrene, 4-, 3-, or 2-alkylstyrene, 3-alkyl-4-hydroxystyrene, 3,5-dialkyl-4-hydroxystyrene, 4-, 3-, or 2-chlorostyrene, 3-chloro-4-hydroxystyrene, 3,5-dichloro-4-hydroxystyrene, 3-bromo-4-hydroxystyrene, 3,5-dibromo-4-hydroxystyrene, vinylbenzyl chloride, 2-vinylnaphthalene, vinylanthracene, vinylanilline, vinylbenzoic acid, vinylbenzoic acid esters, N-vinylpyrrolidone, 1-vinylimidazole, 4-, or 2-vinylpyridine, 1-vinyl-2-pyrrolidinone, N-vinyl lactam, 9-vinylcarbazole, vinyl benzoate, acrylic acid and its derivatives, i.e. methyl acrylate and its derivatives, acrylamide and its derivatives, methacrylic acid and its derivatives, i.e. methyl methacrylate and its derivatives, methacrylamide and its derivatives, acrylonitrile, methacrylonitrile, 4-vinyl benzoic acid and its derivatives, i.e. 4-vinyl benzoic acid esters, 4-vinylphenoxy acetic acid and its derivatives, i.e. 4-vinylphenoxy acetic acid esters, maleimide and its derivatives, N-hydroxymaleimide and its derivatives, maleic anhydride, maleic/fumaric acid and their derivatives, i.e. maleic/fumaric acid ester, vinyltrimethylsilane, vinyltrimethoxysilane, or vinyl-norbornene and its derivatives. Another examples of preferred other monomers usable herein include isopropenylphenol, propenylphenol, poly-(4-hydroxyphenyl) (meth)acrylate, poly-(3-hydroxyphenyl) (meth)acrylate, poly-(2-hydroxyphenyl) (meth)acrylate, N-(4-hydroxyphenyl) (meth)acrylamide, N-(3-hydroxyphenyl) (meth)acrylamide, N-(2-hydroxyphenyl) (meth)acrylamide, N-(4-hydroxybenzyl) (meth)acrylamide, N-(3-hydroxybenzyl) (meth)acrylamide, N-(2-hydroxybenzyl) (meth)acrylamide, 3-(2-hydroxy-hexafluoropropyl-2)-styrene, and 4-(2-hydroxy-hexafluoropropyl-2)-styrene.

Brief Summary Text (133):

According to a preferred embodiment of the present invention, the transmission per micrometer film thickness of the hydroxystyrene based resin is better than 50% for light at irradiation wavelength. The solubility of the resin in a water-soluble standard alkaline developer solution (2.38% tetramethylammonium hydroxide) at 21.degree. C. is preferably above 1,000 angstrom/min, more preferably above 3,000 angstrom/min. According to the composition of the present invention, the base skeleton of the hydroxystyrene based resin is not particularly limited and may be properly determined by taking into consideration applications of the composition, radiation wavelength for exposure, production conditions, chemical composition and the like. According to a preferred embodiment of the present invention, examples of hydroxystyrene based resins usable herein include: poly-(4-hydroxystyrene); poly-(3-hydroxystyrene); poly-(2-hydroxystyrene); and copolymers of 4-, 3-, or 2-hydroxystyrene with other monomers, particularly bipolymers and terpolymers.

Examples of other monomers usable herein include 4-, 3-, or 2-acetoxystyrene, 4-, 3-, or 2-alkoxystyrene, styrene, .alpha.-methylstyrene, 4-, 3-, or 2-alkylstyrene, 3-alkyl-4-hydroxystyrene, 3,5-dialkyl-4-hydroxystyrene, 4-, 3-, or 2-chlorostyrene, 3-chloro-4-hydroxystyrene, 3,5-dichloro-4-hydroxystyrene, 3-bromo-4-hydroxystyrene, 3,5-dibromo-4-hydroxystyrene, vinylbenzyl chloride, 2-vinylnaphthalene, vinylanthracene, vinylanilline, vinylbenzoic acid, vinylbenzoic acid esters, N-vinylpyrrolidone, 1-vinylimidazole, 4-, or 2-vinylpyridine, 1-vinyl-2-pyrrolidinone, N-vinyl lactam, 9-vinylcarbazole, vinylbenzoate, acrylic acid and its derivatives, i.e. methyl acrylate and its derivatives, glycidyl acrylate, acrylamide and its derivatives, methacrylic acid and its derivatives, i.e. methyl methacrylate and its derivatives, glycidyl methacrylate, capped 2-isocyanate ethyl methacrylate, methacrylamide and its derivatives, acrylonitrile, methacrylonitrile, 4-vinyl benzoic acid and its derivatives, i.e. 4-vinyl benzoic acid esters, 4-vinylphenoxy acetic acid and its derivatives, i.e. 4-vinylphenoxy acetic acid esters, maleimide and its derivatives, N-hydroxymaleimide and its derivatives, maleic anhydride, maleic acid and fumaric acid and their derivatives, i.e. maleic acid esters and fumaric acid esters, vinyltrimethylsilane, vinyltrimethoxysilane, or vinyl-norbornene and its derivatives. Another examples of preferred other monomers usable herein include isopropenylphenol, propenylphenol, poly-(4-hydroxyphenyl) (meth)acrylate, poly-(3-hydroxyphenyl) (meth)acrylate, poly-(2-hydroxyphenyl) (meth)acrylate, N-(4-hydroxyphenyl) (meth)acrylamide, N-(3-hydroxyphenyl) (meth)acrylamide, N-(2-hydroxyphenyl) (meth)acrylamide, N-(4-hydroxybenzyl) (meth)acrylamide, N-(3-hydroxybenzyl) (meth)acrylamide, N-(2-hydroxybenzyl) (meth)acrylamide, 3-(2-hydroxy-hexafluoropropyl-2)-styrene, and 4-(2-hydroxy-hexafluoropropyl-2)-styrene.

#### Brief Summary Text (164):

According to a preferred embodiment of the present invention, the chemically amplified radiation sensitive composition of the present invention is used as a photoresist material on a semiconductor substrate. Examples of substrates referred to herein include all those materials for production of capacitors, semiconductors, multi-layer printed circuits or integrated circuits. Specific mention should be made of silicon substrates, silicon oxide, silicon oxynitride, titanium nitride, tungsten nitride, tungsten silicide, aluminum, phosphor-spin-on glass, boron-phosphor-spin-on-glass, gallium arsenide, indium phosphide, and the like. In addition, these substrates may be coated with thin films of organic antireflective coatings consisting of organic polymers and a dye absorbing at the exposure wavelength. Furthermore, suitable substrates are those known from the production of liquid-crystal displays, such as glass or indium tin oxide, and also metal plates and sheets, as well as bimetallic or trimetallic sheets or electrically non-conducting which are coated with metals or paper. These substrates may be thermally pretreated, superficially roughened, incipiently etched or pretreated with chemicals to improve desired properties, such as increase of the hydrophilic nature, or to improve adhesion between the photoresist and the substrate. Preferably used adhesion promoters for silicon or silicon oxide substrates are adhesion promoters of the aminosilane type, such as hexamethyldisilazane, or 3-aminopropyltriethoxysilane.

#### Detailed Description Text (105):

The solution was filtered through a teflon filter having a pore diameter of 0.1 .mu.m, spin coated on a silicon wafer pre-coated with DUV-18, an antireflective coating provided by Brewer Science at a film thickness of 115 nm (bake temperature: 200.degree. C.), at 3,000 revolutions and dried at 90.degree. C. for 60 seconds on a hot plate to remove the solvent. Thus, a 0.72 .mu.m-thick thin film was obtained. The recording material thus obtained was imagewise exposed using a mask providing lines and spaces patterns down to 0.10 .mu.m per image with a DUV stepper Nikon NSR 2005 EX 10B, having a numerical aperture (NA) of 0.55 during exposure and a coherence factor (  $\sigma$  ) of 0.55 with a dose of 18 mJ/cm.<sup>2</sup>. The medium was baked at 100.degree. C. for 90 seconds to develop the latent image, and then processed at 23.degree. C. by puddle development with AZ MIF 300, a surfactant free developer containing 2.38% by weight of tetramethyl ammonium hydroxide provided by Clariant Japan K.K. A defect-free image of the mask with high edge stability was obtained, structures <0.25 .mu.m being resolved faithfully to detail and the width ratio (linearity of the resist) of nominally equal lines/space structures being virtually constant in the range between 1.00 .mu.m and 0.25 .mu.m. The resist profile was

almost vertical and very smooth, as neither edge roughness nor standing waves were observed.

Detailed Description Text (107):

Radical copolymerization of 4-acetoxystyrene, styrene and t-butylmethacrylate was carried out in the presence of 2,2-azo-bis-isobutyronitrile as a polymerization initiator, followed by hydrolysis of the acetate groups with an aqueous ammonium acetate solution to prepare a terpolymer of 4-hydroxystyrene, styrene and t-butyl methacrylate. The terpolymer had a molecular weight of 14,200 with a polydispersity of 1.69 as determined by GPC using polystyrene as the standard, and the molar ratio of 4-hydroxystyrene:styrene:t-butylmethacrylate was 7:2:1 as determined by <sup>1</sup>H NMR. This polymer will be hereinafter often referred to as "POLY 102."

Detailed Description Text (126):

The solutions were filtered, and spin-coated on three silicon wafers, which have been precoated with an experimental antireflective coating provided by Clariant Japan K.K. at a film thickness of 60 nm (bake temperature: 220.degree. C.). The resist films were baked for 60 seconds on a hot plate at 130.degree. C. to yield a film thickness of 0.71.+-.0.02 .mu.m.

Detailed Description Text (168):

Radical copolymerization of 4-acetoxystyrene with 4-t-butylacrylate was carried out in the presence of 2,2'-azobis-(4-dimethoxy-2,4-dimethylvaleronitrile) as a polymerization initiator, followed by hydrolysis of the acetate groups with an aqueous ammonium acetate solution. A part of the hydroxy groups in the copolymer thus obtained were reacted with ethyl vinyl ether in the presence of p-toluenesulfonic acid as a catalyst to prepare a terpolymer of 4-hydroxystyrene, 4-(1-ethoxyethoxystyrene) and 4-t-butylacrylate. The terpolymer had an average molecular weight of 8,700 with a polydispersity of 1.71 as determined by GPC using polystyrene as the standard, and the molar ratio of 4-hydroxystyrene :4-(1-ethoxyethoxy)styrene:4-t-butylacrylate was 7.1:1.8:1.1 as measured by <sup>1</sup>H NMR. This polymer will be hereinafter often referred to as "POLY 107."

Detailed Description Text (211):

The solution was filtered, spin-coated on two silicon wafers pretreated with AZ.RTM. KrF-2, a commercially available antireflective coating available from Clariant Japan K.K., baked for 90 seconds at 120.degree. C. to yield a thin layer having a thickness of 0.51.+-.0.02 .mu.m, and one wafer was exposed as described in Example 101 (NA=0.55, .sigma.=0.80) at a dose of 24 mJ/cm.<sup>2</sup>, while the other wafer was exposed with an ISI ArF stepper with a NA=0.60 and a .sigma.=0.75 at a dose of 11 mJ/cm.<sup>2</sup>. The exposed wafers were baked for 90 seconds at 125.degree. C. and developed.

Detailed Description Text (275):

The solutions were filtered, and spin coated on two silicon wafers each, which have been precoated with DUV 30, an antireflective coating provided by Brewer Science at a film thickness of 90 nm (bake conditions: 190.degree. C./60 sec). The substrate reflectivity at this film thickness was approximately 6%. The films were baked for 90 seconds at 120.degree. C. to yield thin films having a thickness of 0.72.+-.0.01 .mu.m and exposed as described in Example 101. The exposure was followed by a post exposure bake at 120.degree. C. for 60 seconds and a development.

Detailed Description Text (288):

The solutions were filtered, and spin coated on two silicon wafers each, which have been precoated with DUV 42, a antireflective coating provided by Brewer Science Corp., USA, at a film thickness of 60 nm (bake conditions: 200.degree. C./60 sec). The substrate reflectivity at this film thickness was less than 5%. Baking for 90 seconds at 90.degree. C. provided a thin layer having a thickness of 0.65.+-.0.01 .mu.m. Top-view inspection of the photoresists by microscope and scanning electron microscope indicated that all three films exhibited smooth surfaces without any sign of pinholes, popcorns, or cracking. The recording materials were exposed as described in Example 101 (NA=0.55, .sigma.=0.55) using a half-tone mask with 0.3 .mu.m contact hole patterns at a dose of 18 mJ/cm.<sup>2</sup>, baked at 105.degree. C. for 90 seconds and developed.

Detailed Description Text (302):

The solutions thus obtained were filtered and spin coated on two silicon wafers each, which have been precoated with AZ KrF-2 (tradename), an antireflective coating provided by Clariant Japan K.K., at a film thickness of 60 nm (bake conditions: 220.degree. C./60 sec). The photoresist films were baked for 90 seconds at 115.degree. C. to yield a film thickness of 0.62. $\pm$ 0.01  $\mu$ m. After exposure as described in Example 101 (NA=0.55,  $\sigma$ =0.55) at a dose of 29 mJ/cm<sup>2</sup>, the exposed wafers were baked at 120.degree. C. for 90 seconds and developed.

Detailed Description Text (312):

The solution thus obtained was filtered and spin coated on a wafer precoated with a 160 nm thick film of AZ Barli (tradename), a commercial antireflective coating available from Clariant Japan K.K., which has been baked at 200.degree. C. for 60 seconds. The photoresist was baked at 110.degree. C. for 60 seconds to give a film thickness of 850 nm. The coated wafer was exposed through a mask with line and space patterns down to 0.20  $\mu$ m using a Nikon SNR1705I stepper (NA=0.50) at a dose of 56 mJ/cm<sup>2</sup>. After the exposure, the wafer was baked at 90.degree. C. for 60 seconds and developed as described in Example 101. After water rinsing, the wafer was dried and observed under SEM. The material resolved 0.26  $\mu$ m lines and space patterns free of scum and T-top formation.

Detailed Description Text (320):

The solution thus obtained was filtered and spin coated on a wafer precoated with a 60 nm thick film of an experimental methacrylate based antireflective coating developed by Clariant Japan K.K., which has been baked at 200.degree. C. for 60 seconds. The photoresist was baked at 90.degree. C. for 60 seconds to give a film thickness of 450 nm and exposed through a mask with line and space patterns down to 0.10  $\mu$ m using a ISI ArF excimer laser with a NA=0.60 at a dose of 14.5 mJ/cm<sup>2</sup>. After the exposure, the wafer was baked at 110.degree. C. for 60 seconds and developed with an aqueous developer AZ MIF 300 (tradename: available from Clariant Japan K.K.) containing 2.38% tetramethyl ammonium hydroxide for 60 seconds at 230.degree. C. The material resolved 0.14  $\mu$ m lines and space pattern without any T-top formation. The interface between the antireflective coating and the photoresist was free of scum.

Detailed Description Text (480):

The solution was filtered through a teflon filter having a pore diameter of 0.1  $\mu$ m, spin coated on a silicon wafer pre-coated with DUV-18, an antireflective coating provided by Brewer Science at a film thickness of 115 nm (bake temperature: 200.degree. C.), at 3,000 revolutions and dried at 90.degree. C. for 60 seconds on a hot plate to remove the solvent. Thus, a 0.75  $\mu$ m-thick film was obtained. The recording material thus obtained was imagewise exposed using a mask providing lines and spaces patterns down to 0.10  $\mu$ m per image with a DUV stepper Nikon NSR 2005 EX 10B, having a numerical aperture (NA) of 0.55 during exposure and a coherence factor ( $\sigma$ ) of 0.55 with a dose of 22 mJ/cm<sup>2</sup>. The material was baked at 100.degree. C. for 90 seconds to develop the latent image, and then processed at 23.degree. C. by puddle development with AZ 300 MIF (tradename), a surfactant free developer containing 2.38% by weight of tetramethyl ammonium hydroxide provided by Clariant Japan K.K. A defect-free image of the mask with high edge stability was obtained, structures <0.25  $\mu$ m being resolved faithfully to detail and the width ratio (linearity of the resist) of nominally equal lines/space structures being virtually constant in the range between 1.00  $\mu$ m and 0.25  $\mu$ m. In 250 nm image, the difference in linewidth between dense lines and isolated lines was not more than 5 nm, and the dense/iso bias was very small. The resist profile was almost vertical and very smooth, as neither line edge roughness nor standing waves were observed.

Detailed Description Text (482):

Radical copolymerization of 4-acetoxystyrene, styrene and t-butylmethacrylate was carried out in the presence of 2,2-azo-bis-isobutyronitrile as a polymerization initiator, followed by hydrolysis of the acetate groups of the copolymer with an aqueous ammonium acetate solution to prepare a terpolymer of 4-hydroxystyrene, styrene and t-butyl methacrylate. The terpolymer had a molecular weight of 14,200 with a polydispersity of 1.69 as determined by GPC using polystyrene as the standard, and the molar ratio of 4-hydroxystyrene:styrene:t-butylmethacrylate was 7:2:1 as determined by <sup>1</sup>H NMR (POLY 202). The following ingredients were mixed

together to prepare a solution of a positive-working chemically amplified radiation sensitive composition suitable for DUV (248 nm) exposure:

Detailed Description Text (499):

The solutions were filtered, and spin-coated on three silicon wafers, which have been precoated with an experimental antireflective coating provided by Clariant Japan K.K. at a film thickness of 60 nm (bake temperature: 220.degree. C.). The resist films were baked for 60 seconds on a hot plate at 90.degree. C. to yield a film thickness of 0.75.+-.0.02 .mu.m.

Detailed Description Text (544):

Radical copolymerization of 4-acetoxystyrene with 4-t-butylacrylate was carried out in the presence of 2,2'-azobis-(4-dimethoxy-2,4-dimethylvaleronitrile) as a polymerization initiator, followed by hydrolysis of the acetate groups with an aqueous ammonium acetate solution. A part of the hydroxy groups in the copolymer thus obtained were reacted with ethyl vinyl ether in the presence of p-toluenesulfonic acid as a catalyst to prepare a terpolymer of 4-hydroxystyrene, 4-(1-ethoxyethoxystyrene) and 4-t-butylacrylate. The terpolymer had an average molecular weight of 8,700 with a polydispersity of 1.71 as determined by GPC using polystyrene as the standard, and the molar ratio of 4-hydroxystyrene:4-(1-ethoxyethoxy)styrene:4-t-butylacrylate was 7.1:1.8:1.1 as measured by .sup.1 H NMR (POLY 207). The following ingredients were mixed together to prepare a solution of a positive-working chemically amplified radiation sensitive composition suitable for DUV (248 nm) and e-beam exposure:

Detailed Description Text (584):

The solution was filtered, spin-coated on two silicon wafers pretreated with AZ.RTM. KrF-2, a commercially available antireflective coating available from Clariant Japan K.K, baked for 90 seconds at 120.degree. C. to yield a layer having a thickness of 00.55.+-.0.02 .mu.m, and one wafer was exposed as described in Example 201 (NA=0.55, .sigma.=0.80) at a dose of 26 mJ/cm.sup.2, while the other wafer was exposed with an ISI ArF stepper with a NA=0.60 and a .sigma.=0.75 at a dose of 12.5 mJ/cm.sup.2. The exposed wafers were baked for 90 seconds at 125.degree. C. and developed.

Detailed Description Text (659):

For comparison, positive-working chemically amplified radiation sensitive composition solutions were prepared in the same manner as described just above, except that 0.66 g (0.708 mmol) of tris-(4-t-butylphenyl)sulfonium perfluorooctane sulfonate (Comparative Example 205) or 0.41 g (0.708 mmol) of tris-(4-t-butylphenyl)sulfonium trifluoromethane sulfonate (Comparative Example 206) was used instead of 0.52 g (0.708 mmol) of tris-(4-t-butylphenyl) sulfonium nonafluorobutane sulfonate. The solutions were filtered, and spin coated on two silicon wafers each, which have been precoated with DUV 30, an antireflective coating provided by Brewer Science at a film thickness of 90 nm (bake conditions: 190.degree. C./60 sec). The substrate reflectivity at this film thickness was approximately 6%. The films were baked for 90 seconds at 120.degree. C. to yield films having a thickness of 0.72.+-.0.01 .mu.m and exposed as described in Example 201. The exposure was followed by a post exposure bake at 120.degree. C. for 60 seconds and a development.

Detailed Description Text (671):

The solutions were filtered, and spin coated on two silicon wafers each, which have been precoated with DUV 42, a antireflective coating provided by Brewer Science Corp., USA, at a film thickness of 60 nm (bake conditions: 200.degree. C./60 sec). The substrate reflectivity at this film thickness was less than 5%. Baking for 90 seconds at 90.degree. C. provided a layer having a thickness of 0.65.+-.0.01 .mu.m. Top-view inspection of the photoresists by microscope and scanning electron microscope indicated that all three films exhibited smooth surfaces without any sign of pinholes, popcorns, or cracking. The recording materials were exposed as described in Example 201 (NA=0.55, .sigma.=0.55) using a half-tone mask with 0.3 .mu.m contact hole patterns at the following dose, baked at 105.degree. C. for 90 seconds and developed.

Detailed Description Text (684):

The solutions thus obtained were filtered and spin coated on two silicon wafers

each, which have been precoated with AZ KrF-2 (tradename), an antireflective coating provided by Clariant Japan K.K., at a film thickness of 60 nm (bake conditions: 220.degree. C./60 sec). The photoresist films were baked for 90 seconds at 115.degree. C. to yield a film thickness of 0.62. $\pm$ 0.01  $\mu$ m. After exposure as described in Example 201 (NA=0.55,  $\sigma$ =0.55) at a dose of 32 mJ/cm.<sup>2</sup>, the exposed wafers were baked at 120.degree. C. for 90 seconds and developed.

Detailed Description Text (694):

The solution thus obtained was filtered and spin coated on a wafer precoated with a 160 nm thick film of AZ Barli (tradename), a commercial antireflective coating available from Clariant Japan K.K., which has been baked at 200.degree. C. for 60 seconds. The photoresist was baked at 110.degree. C. for 60 seconds to give a film thickness of 850 nm. The coated wafer was exposed through a mask with line and space patterns down to 0.20  $\mu$ m using a Nikon SNR1705I stepper (NA=0.50) at a dose of 56 mJ/cm.<sup>2</sup>. After the exposure, the wafer was baked at 90.degree. C. for 60 seconds and developed as described in Example 201. After pure water rinsing, the wafer was dried and observed under SEM. The material resolved 0.26  $\mu$ m lines and space patterns free of scum and T-top formation.

Detailed Description Text (702):

The solution thus obtained was filtered and spin coated on a wafer precoated with a 60 nm thick film of an experimental methacrylate based antireflective coating provided by Clariant Japan K.K., which has been baked at 200.degree. C. for 60 seconds. The photoresist was baked at 90.degree. C. for 60 seconds to give a film thickness of 450 nm and exposed through a mask with line and space patterns down to 0.10  $\mu$ m using a ISI ArF excimer laser with a NA=0.60 at a dose of 14.5 mJ/cm.<sup>2</sup>. After the exposure, the wafer was baked at 110.degree. C. for 60 seconds and developed with an aqueous developer AZ MIF 300 (tradename: available from Clariant Japan K.K.) containing 2.38% tetramethyl ammonium hydroxide for 60 seconds at 23.degree. C. The material resolved 0.14  $\mu$ m lines and space pattern without any T-top formation. The interface between the antireflective coating and the photoresist was free of scum.

## WEST Search History

DATE: Wednesday, May 07, 2003

### Set Name Query

side by side

### Hit Count Set Name

result set

*DB=USPT,PGPB,JPAB,EPAB,DWPI; PLUR=YES; OP=ADJ*

L29	L21 and (antireflective or arc)	0	L29
L28	L27 and l4	12	L28
L27	(antireflective coating)	2902	L27
L26	(antireflective coating or arc)	357823	L26

*DB=EPAB,DWPI; PLUR=YES; OP=ADJ*

L25	199302146	0	L25
L24	WO199302146	0	L24
L23	WO-199302146	0	L23
L22	009302146	0	L22

*DB=USPT,PGPB,JPAB,EPAB,DWPI; PLUR=YES; OP=ADJ*

L21	L20 and acetoxystyrene	1	L21
L20	kitson-anthony\$.in.	19	L20
L19	L18	8	L19

*DB=EPAB,DWPI; PLUR=YES; OP=ADJ*

L18	kitson-anthony\$.in.	8	L18
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*DB=PGPB; PLUR=YES; OP=ADJ*

L17	2003077538	0	L17
L16	2001948182	0	L16

*DB=EPAB,DWPI; PLUR=YES; OP=ADJ*

L15	023515	0	L15
L14	000023515	0	L14
L13	2003023515	1	L13

*DB=USPT; PLUR=YES; OP=ADJ*

L12	5324788.pn.	1	L12
L11	324788.pn.	0	L11

*DB=USPT,JPAB,EPAB,DWPI; PLUR=YES; OP=ADJ*

L10	20010051133	1	L10
L9	L8 and (hydroxy\$4yl \$4acrylate or hydroxy\$4yl\$4acrylate or HEMA)	46	L9
L8	L7 and l4	131	L8
L7	((526/\$)!.CCLS.)	48495	L7

L6	L4 with copolymer with (hydroxy\$4yl acrylate or hydroxy\$4ylacrylate)	1	L6
L5	L4 adj3 copolymer adj3 (hydroxy\$4yl acrylate or hydroxy\$4ylacrylate)	0	L5
L4	L1 or l2	950	L4
L3	L2 or l2	171	L3
L2	vinylphenyl acetate or vinyl phenylacetate	171	L2
L1	acetoxystyrene or acetoxy styrene	836	L1

END OF SEARCH HISTORY